ImREAL – Immersive reflective experience-based adaptive learning
Augmented virtuality

The collaborative international project ImREAL is modernising the use of immersive simulated environments for learning. Project coordinator Dr Vania Dimitrova from the University of Leeds has invited consortium partners to discuss their innovative work and the important role of collaboration in the project.

Can you outline the key goal of Immersive Reflexive Experience-based Adaptive Learning (ImREAL)? How will the project go about achieving these aims?

Dr Declan Dagger (DD) – CEO of EmpowerTheUser: Immersive simulators have been the preferred method of training for elite disciplines for many years (flight simulators, army simulators, space simulators, etc.). Now we have the opportunity to bring simulation-based training to the masses, effectively and cheaply.

Dr Lydia Lau (LL) – University of Leeds: ImREAL’s key goal is to make the learning environment more inclusive of the life experiences that emerge from a diverse group of people, not only from a handful of experts who were involved in the design and authoring of the learning content. This is particularly appealing for the adult learning of soft skills (such as non-verbal interpersonal communications, with cultural variations).

Sonia Hetzner (SH) – Friedrich-Alexander Universität Erlangen-Nürnberg: The project is developing concepts and the respective tools for augmenting the design and performance of all types of eLearning. The source of information is innovative: the social web (eg. Twitter, Flickr, YouTube, blogs) and its integration into concrete pedagogical scenarios in a cost-effective and intelligent way. The information is used for both the design of the learning experience and the training.

Professor Geert-Jan Houben (G-JH) – Technische Universität Delft: ImREAL tries to understand how learning applications can be augmented with knowledge from the real world. The claim is that learning systems can adapt better to the learners if they can also rely on knowledge from outside the system itself; knowledge that reflects the real situation of the trainee, not the situation that the system assumes to hold.

Dr Adam Moore (AM) – Trinity College Dublin: The main challenge is to ensure that support is timely, relevant and contextual. It is also important that it is provided when required and fades away otherwise – not becoming distracting or overwhelming.

How will closing the gap between the real and virtual world help to improve learning?

Dr Christina Steiner (CS) – Technische Universität Graz: Closing (or narrowing) the gap between the real and virtual world means to make simulations relevant and authentic for learners and for their needs in job practice. A virtual world can never be real, but the main feature of a good simulation should be to capture (nearly) all important elements of the situation in question, while leaving out irrelevant aspects. The outcome of the research in ImREAL should optimally be to leverage learning simulations, such that the transfer of knowledge/skills acquired in the simulation into real-world situations is supported.

AM: The desired result is that the simulations in the virtual world prepare learners for the real world, providing valuable insight and pragmatic experience of situations they will encounter, as well as support of their learning similar to that they would have with real-world training. From my point of view, the best result would be that the learners come out of the simulated experience prepared for activities in the real world, with clear and realistic expectations.

DD: ImREAL achieves this in two ways. Firstly it allows the ‘live’ learning experience to be responsive to the individual characteristics of each learner, eg. providing culturally sensitive feedback and augmenting metacognitive and reflective scaffolding. Secondly, via digital traces it allows the learning experience to evolve and incorporate information and feedback from the real working environment. Essentially, the Simulated training world and Real application world become intricately linked.

Dr Alistair Norman – University of Leeds: In short, we are making simulations more realistic and thus more effective. The project aims to make use of digital traces to inform...
Intelligent analysis of social web behaviour (e.g., Twitter or Flickr) provides information about the learner’s cultural exposure, which is used for tailoring the system feedback to the learner. Reflection activities are triggered in an effective way using metacognitive scaffolding prompts. User-generated content during the simulation is further analysed to gain insights into user experiences with the simulator.

the process of simulation design and thus improve the quality of simulations designed.

Which elements are key to a successful immersive simulated environment? What role do you envisage these environments playing?

Lucia Pannese (LP) – CEO of Imaginary Srl: Key elements of success are user engagement and participation (both in the setup phase and during its use), social interaction, the facility to share knowledge and experiences, high fidelity and high quality graphics, dependent on whether they are representing real or fantasy worlds.

SH: A good immersive learning experience allows the learner to practice in authentic situations, reflecting his training needs and promotes immersion. Immersion occurs when the environment shows relevance regarding the training needs of the learner, has an adequate difficulty level and provides personalised supportive feedback.

G-JH: A good training environment has a good perception of what the trainee is and their needs.

DD: The key elements of a successful immersive simulated environment are: interaction, through giving control over outcomes to the user; immersion, as narratives and flows are realistic and highly engaging; fidelity, because of the level of correlation to real-life situations being simulated; coaching, with timely, targeted and personalised feedback on performance and decisions; reflection opportunities, to analyse the cause and effect of decisions and actions; and repetition, to practise and master skills.

Can you outline the ways in which ImREAL intelligent services help to contextualise and translate simulated environments into real-world job practice?

Dr Stan Karanasios (SK) – University of Leeds: Through better representation of the context and the issues surrounding that context, people can better immerse themselves in the learning environment. Our work has already shown that social web content does reflect the real world, and that there are benefits and potential in making the most of its content.

G-JH: This is made possible by achieving a better understanding of the trainee, improving provision of material that is realistic for the trainee, and by allowing trainees themselves to help the system understand them and their needs.

LL: We achieve this by sensing the context of learners using semantics; by sensing the relevant experiences in social media (comments, tweets) using social science models, ontologies and digital trace analyses; and by opening up the simulator-development environment to external content.

How can adaptive systems be adjusted to meet the needs of adult learners?

LP: There are different levels to how this can be achieved. A system needs a good competence model behind it that supports choice of contents and degrees of complexity. A good user profiling system is key, with a flexible structure so that quick and focused portions can be consumed.

CS: Learners come into learning situations with completely different starting conditions: having different backgrounds and with different levels of prior knowledge, coming from different institutions/organisations, having differing learning goals, possessing diverse learning competences, etc. This variation is naturally even larger for adult learners than it is for school pupils and adolescent learners. With adaptive systems, the variability in learners’ characteristics can be taken into account and learning experiences can be tailored to each individual’s specific needs and knowledge.

Which different sectors are targeted by the project and can you give an insight into the key activities conducted within these sectors?

LP: ImREAL is targeting different sectors, the main one being the training sector. This is addressed in two very different ways: from the point of view of training producers (instructional designers or companies offering training), ImREAL is suggesting technology-based solutions to enhance and make swifter the process of creating content for simulators; and from the point of view of the training itself, new kinds of interactive, adaptive simulation systems are being integrated into more traditional training structures.

DD: The project targets medical practitioner training. Effective communication is now positioned as a core skill for medical professionals because ineffective communication can lead to misdiagnosis, patient disengagement and litigation, to name a few examples. Face-to-face role-play has been the preferred method of training for clinical communications because of its practical and immersive nature. However, escalating costs, increased student numbers and decreased budgets have opened the door to interactive online methods of role-play and teaching communication skills. This is exactly where immersive simulations and the ImREAL project are adding significant value.

Do the numerous collaborators in ImREAL bring a variety of expertise to the table?

SK: The consortium is made up of a range of academic partners with a variety of skills and disciplinary backgrounds – from computer science, user modelling, social science and pedagogy. There are also a range of specialisation SME developing simulators in different contexts.

G-JH: Alongside these, the partners also specialise in social web analytics, commercial applications for learning and research into pedagogy. We have a globally leading role in the use of semantic social techniques for modelling trainees and training material.
Making simulations relevant to real-world experience

Experiential learning environments – eg. simulations or serious games – create a practical context in which novel skills can be learned. These environments face a major challenge: how to effectively align the learning experience in the simulated environment with the real-world context, recognising and addressing the needs of individual learners. Made up of five academic groups and two SMEs, the Immerse The User (ImREAL) project pioneers a new psycho-pedagogically sound technological approach to address this challenge.

THE TECHNOLOGY-ENHANCED LEARNING market has flourished in the last few years and a number of systems are now deployed in schools and universities. The creation of immersive simulated environments for experiential learning is one area in particular which is rapidly growing in popularity. Simulated environments have great potential as a means of training employees in the workplace. Operated on a PC, simulation-based training represents a much cheaper alternative to personalised training by a trainer or coach. Yet virtual training tools are seldom as effective.

Usually immersive simulated environments are designed for a very specific experience and incorporate a limited understanding of the learner based solely on the interaction within the simulated world. Such environments are designed to satisfy the perceived needs of learners, but they are often totally disconnected from the learners’ everyday experiences. Furthermore, the authenticity and job relevance of the platform is inevitably based upon the insights and value systems of the simulator developers. Since the content of the simulated environment is drawn from a fairly static and limited knowledge pool, simulators can often miss the wealth of experiences and the breadth of real-world situations. Simulations typically reflect a snapshot of time and training needs; it is also time consuming to adapt the content and interaction to frequently changing work contexts and learning needs.

To address these issues, a consortium of European partners has launched the Immersive Reflective Experience-based Adaptive Learning (ImREAL) project, funded by the EU Seventh Framework Programme (FP7). The team is comprised of five academic groups from the University of Leeds, UK; Trinity College Dublin, Ireland; Technische Universität Graz, Austria; Friedrich-Alexander Universität Erlangen-Nuernberg, Germany; and Technische Universität Delft, The Netherlands; alongside two SMEs – Imaginary Srl, Italy and EmpowerTheUser Ltd, Ireland – who develop training simulations. Project Coordinator Dr Vania Dimitrova from the University of Leeds highlights the importance of the project: “ImREAL embarks on an extremely challenging problem which is highly important for effective technology-enhanced learning for 21st Century skills and contexts. We tackle this in a collaborative partnership with the active involvement of world-leading experts in computer science, psychology, education and social science, working together with simulation companies and end users”.

PLUGGING THE GAP

ImREAL aims to plug the gap between the real and virtual world by building on the blurring boundaries between physical, social and digital worlds, and exploiting the massive potential of social content. Social spaces, if properly utilised, can provide an extensive source of reports on individuals’ experiences and their real-world job contexts. Central to the project is the development of a novel conceptual framework and innovative semantic-enhanced intelligent services to exploit digital traces with user-generated content in social spaces to both develop a model of real-world activities and derive relevant learner characteristics. By providing intelligent ways for analysing social content, the ImREAL services help simulator developers to better align the simulated situations with real-world experiences. Furthermore, these services augment learner experiences in simulated environments by providing adaptive metacognitive scaffolding to support self-regulated learning. Through the use of self-growing adaptive simulations which guide the learner via a virtual mentor, ImREAL will help learners to reflect on the experiences they work through. The desired result is that the simulations in the virtual world will prepare learners for the real world, providing valuable insight and pragmatic experience of situations they will encounter, as well as supporting their learning in a manner similar to real-world training.

The team is targeting the development of simulation systems for ‘soft skills’ training, focusing on interpersonal communication and multicultural awareness. These skills are particularly important when managing relationships in the workplace, dealing with customer enquiries, providing advice or interviewing individuals such as patients. Helping learners to improve their ability to communicate with people from different cultures is key to this.

PROJECT STRUCTURE

In order to accomplish the ambitious goals of the project, the ImREAL researchers have organised their work in a series of Work Packages (WP). A systematic methodology for extending simulators to enable adult self-regulated learning is being developed in WP2. This underpins the technical development and use cases in the project. Merging social science methods, such as activity theory, and computer science approaches, such as semantic augmentation and exploration, WP3 has developed a framework for making sense of digital traces to identify relevant real-life experiences expressed in social spaces (eg. blogs, stories, and comments on the web). Further to this, WP4 has developed a framework for modelling users from social spaces, which was applied to content from social media sites, such as Twitter, Flickr and YouTube. Underpinning this work are semantic techniques which enable a deeper understanding of user-generated content. Scaffolding work to augment immersive simulators has been central to the team’s work in WP5. Their affective metacognitive scaffolding service creates a way to provide interventions that prompt learners in real time, which improves a learner’s awareness of their skills. The service is appropriately designed to positively impact on a learner’s motivation by heightening their perception of their emotional state. The integration of the services and simulated learning environments is realised in WP6, while carefully designed user trials in WP7 examine the validity of the approach and its effectiveness.

AUGMENTING SIMULATORS

The ImREAL framework and intelligent services are applied in two soft skill simulators developed by Imaginary Srl and EmpowerTheUser Ltd, respectively. This allows the researchers to check the possibilities and constraints of their work, whilst systematically evaluating the feasibility of the ImREAL approach and the impact it can make on simulator development and use. The experiences with deploying ImREAL services in both simulators will showcase how these services can enhance simulator development and deployment in training practice.
ImREAL aims to plug the gap between the real and virtual world by building on the blurring boundaries between physical, social and digital worlds, and exploiting the massive potential of social content.

FUTURE PLANS

To ensure that the success of ImREAL continues, the team intends to increase personalisation of the learning experience of an individual learner. This will involve the further use of social web content, particularly in order to support and encourage adult learners. “In the near future, we will see follow-up work that adopts and extends the ImREAL approach in developing the intelligent learning technologies of tomorrow,” Dimitrova adds. Alongside this, the consortium will be exploring developments in other non-learning areas to exploit the enormous potential of social content, eg. emergency response, intelligent marketing and social recommendations, to mention a few.

ACHIEVEMENTS

The project has already achieved notable successes. It has helped simulator developers to not only think about the realism and real-world relevance of the simulation content, but has also enabled them to do this by using ImREAL services. The simulator effectiveness is improved by providing better adaptation and by prompting learners to reflect on their own learning during and after the simulated experience. In so doing, ImREAL has quickly developed into a world-leading initiative with a distinct focus. Unlike many other simulated learning approaches, ImREAL has delved into the complexities and nuances of social computing, being one of the very few to address issues surrounding the use and reuse of social web content for educational potential. “ImREAL is at the forefront of intelligent learning environments capable of linking real-world context, adapting to learner needs, and providing engaging and motivating learning experiences. It opens up a new avenue for developing innovative approaches to exploit the potential of social content and improve virtual environments in a broad range of contexts and domains,” summarises Dimitrova.

PARTNERS

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DR VANIA DIMITROVA is currently Associate Professor in the School of Computing at the University of Leeds. With a PhD in Artificial Intelligence in Education, her research concerns the development of intelligent systems (driven by real-life practice and problems) that adapt to individuals, groups and communities. Areas of interest include: learner/user modelling, dialogic interaction, knowledge capture, metacognitive skills, community adaptation, ontological modelling and reasoning. Dimitrova has produced over 100 papers in the area and has participated in national and international multidisciplinary research projects, collaborating closely with educational professionals, academia and industry.